

## CLAIMS

1 1. A modular conveyor belt comprising a series of rows of belt modules and hinge pins  
2 hingedly interlinking consecutive belt rows end-to-end to form an endless conveyor belt, each row  
3 including at least one module comprising a body section extending from a first end to a second  
4 end in the direction of belt travel, a first plurality of hinge elements along the first end, and a  
5 second plurality of hinge elements along the second end, the first plurality of hinge elements of a  
6 row being interleaved with the second plurality of hinge elements of an adjacent row and pivotally  
7 joined by a hinge pin in a hinged connection between consecutive rows of belt modules, wherein  
8 the body section of at least some of the modules includes a bottom surface and an opposite upper  
9 deck forming a substantially continuous upper surface except for at least one cavity formed in the  
10 body section and opening onto the upper surface and a roller rotatably disposed in the cavity for  
11 rolling contact with articles conveyed on the belt.

1 2. A modular conveyor belt as in claim 1 wherein the cavity extends from the upper surface  
2 completely through the body section to an opening in the bottom surface.

1 3. A modular conveyor belt as in claim 1 wherein the body section includes a transverse drive  
2 element extending downward from the bottom surface and wherein the cavity does not extend  
3 through the drive element.

1 4. A modular conveyor belt as in claim 1 wherein the roller is cylindrically-shaped.

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1 5. A modular conveyor belt as in claim 4 wherein the roller rotates about an axis of rotation  
2 perpendicular to the direction of belt travel.

1 6. A modular conveyor belt as in claim 4 wherein the roller rotates about an axis of rotation  
2 parallel to the direction of belt travel.

1 7. A modular conveyor belt as in claim 1 wherein the upper surface slopes upwardly from the  
2 first end and from the second end and wherein the cavity is formed between the first end and the  
3 second end, the sloping upper surface tending to guide askew articles into a conveying position  
4 atop the roller.

1 8. A modular conveyor belt as in claim 4 further comprising an axle and wherein the roller  
2 includes a central bore encircling the axle and wherein the cavity is bounded by two opposite  
3 walls having collinear holes to support opposite ends of the axle.

1 9. A modular conveyor belt as in claim 8 wherein the body section includes a plurality of  
2 cavities arranged transversely across the row and the collinear holes are arranged to communicate  
3 with each other and the cavities to form a passageway along an axis perpendicular to the direction  
4 of belt travel and wherein the axle extends through the passageway and the bores of the rollers  
5 disposed in the plurality of cavities.

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1 10. A modular conveyor belt as in claim 6 further comprising an axle along the axis of rotation  
2 parallel to belt travel and wherein the roller includes a central bore encircling the axle and wherein  
3 the cavity is bounded by two opposite walls having collinear holes to support opposite ends of the  
4 axle.

1 11. A modular conveyor belt as in claim 10 wherein at least one of the collinear holes opens  
2 into a gap between consecutive hinge elements of the row and wherein the axle is retained in the  
3 collinear holes by an interleaved hinge element of an adjacent row disposed in the gap.

1 12. A modular conveyor belt as in claim 1 wherein the roller is a freely-rotating ball.

1 13. A modular conveyor belt as in claim 12 wherein the cavity includes a recessed surface  
2 supporting bearing elements providing low-friction bearing surfaces for the ball.

1 14. A modular conveyor belt as in claim 13 wherein the bearing elements comprise ridges  
2 extending from the recessed surface of the cavity.

1 15. A modular conveyor belt as in claim 13 wherein the bearing elements comprise a plurality  
2 of ball bearings and a ball bearing holder containing the ball bearings.

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1 16. A modular conveyor belt as in claim 12 further comprising a cover extending from the  
2 upper deck of the body section, the cover having a circular aperture therethrough with a diameter  
3 less than the diameter of the ball to allow a portion of the ball to extend through the circular  
4 aperture into rolling contact with conveyed articles, while retaining the ball in the cavity free to  
5 rotate.

1 17. A modular conveyor belt as in claim 16 further comprising retention structure in the upper  
2 deck of the module body and mating retention elements on the cover, the retention elements  
3 engaging the retention structure to affix the cover to the module body.

1 18. A modular conveyor belt as in claim 12 further comprising a cover at the upper deck of  
2 the module body, the cover forming a circular aperture therethrough and including a lip bordering  
3 the circular aperture and including an adjustable portion for adjusting the lip to change the  
4 diameter of the circular aperture from a first diameter greater than the diameter of the ball to  
5 admit a ball into the cavity to a second diameter less than the diameter of the ball to retain the ball  
6 in the cavity free to rotate with a portion of the ball protruding through the aperture into rolling  
7 contact with conveyed articles.

1 19. A modular conveyor belt as in claim 18 wherein the adjustable portion is deformed to  
2 adjust the lip to change the diameter of the circular aperture from the first diameter to the second  
3 diameter.

1 20. A modular conveyor belt as in claim 12 wherein the ball is made of a plastic material.

1 21. A modular conveyor belt as in claim 4 further comprising a rotatable support, including a  
2 pivot, disposed in the cavity to pivot about a pivot axis and an axle supported at both ends by the  
3 rotatable support and encircled by the roller for rotation about the axis of the axle, wherein the  
4 axis of the axle and the pivot axis are in non-intersecting relationship..

1 22. A modular conveyor belt as in claim 21 wherein the axis of the axle and the pivot axis lie  
2 in perpendicular planes.

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1 23. A modular conveyor belt suitable for transferring articles off a side edge of the belt,  
2 comprising a series of rows of belt modules and hinge pins hingedly interlinking consecutive belt  
3 rows end-to-end to form an endless conveyor belt, each row extending between two side edges  
4 and including at least one module comprising a body section extending from a first end to a  
5 second end in the direction of belt travel and forming an upper article conveying surface, a first  
6 plurality of hinge elements along the first end, and a second plurality of hinge elements along the  
7 second end, the first plurality of hinge elements of a row being interleaved with the second  
8 plurality of hinge elements of an adjacent row and pivotally joined by a hinge pin in a hinged  
9 connection between consecutive rows of belt modules, wherein the body section of at least some  
10 of the modules includes:  
11 a pair of opposing walls formed in the body section transverse to the direction of belt  
12 travel and bounding a cavity opening onto the upper article conveying surface, each wall having a  
13 hole in the direction of belt travel and aligned with the hole in the opposing wall,  
14 an axle supported in the aligned holes, and  
15 a roller disposed in the cavity with a salient portion protruding above the upper article  
16 conveying surface and having a central bore encircling the axle for rotation about an axis of  
17 rotation in the direction of belt travel as defined by the axle,  
18 wherein at least one of the aligned holes opens into a gap between consecutive hinge  
19 elements of the belt row.

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1 24. A modular conveyor belt comprising a series of rows of belt modules and hinge pins  
2 hingedly interlinking consecutive belt rows end-to-end to form an endless conveyor belt, each row  
3 including at least one module comprising a body section extending from a first end to a second  
4 end in the direction of belt travel, a first plurality of hinge elements along the first end, and a  
5 second plurality of hinge elements along the second end, the first plurality of hinge elements of a  
6 row being interleaved with the second plurality of hinge elements of an adjacent row and pivotally  
7 joined by a hinge pin in a hinged connection between consecutive rows of belt modules, wherein  
8 the body section of at least one of the modules includes a bottom surface and an opposite upper  
9 article conveying surface and at least one cavity formed between the first end and the second end  
10 and opening onto the upper article conveying surface and a roller rotatably disposed in the cavity  
11 for rolling contact with conveyed articles, wherein the upper article conveying surface slopes  
12 upwardly from the first end and from the second end toward the roller to help guide askew  
13 articles into a conveying position atop the roller.

1 25. A conveyor belt module comprising:

2 a body section extending from a first end to a second end and including a bottom surface  
3 and an opposite upper article conveying surface and at least one cavity formed between the first  
4 end and the second end and opening onto the upper article conveying surface;

5 a first plurality of hinge elements along the first end;

6 a second plurality of hinge elements along the second end; and

7 a roller rotatably disposed in the cavity with a salient portion of the roller protruding from  
8 the cavity;

9 wherein the contour of the upper article conveying surface slopes upwardly from the first  
10 end and from the second end toward the roller.

1 26. A conveyor belt module comprising:

2 a body section extending from a first end to a second end;

3 a first plurality of hinge elements along the first end;

4 a second plurality of hinge elements along the second end;

5 wherein the body section of at least some of the modules includes a bottom surface and  
6 an opposite upper deck forming a substantially continuous upper surface except for at least one  
7 cavity formed in the body section and opening onto the upper surface and a roller rotatably  
8 disposed in the cavity with a salient portion protruding through the upper surface.



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1 27. A conveyor belt module, comprising:

2 a body section extending from a first end to a second end and in a transverse direction  
3 from a first module side edge to a second module side edge and forming an upper article  
4 conveying surface;

5 a first plurality of hinge elements along the first end;

6 a second plurality of hinge elements along the second end;

7 wherein the body section of at least some of the modules includes;

8 a pair of opposing walls formed in the body section in the transverse direction and  
9 bounding a cavity opening onto the upper article conveying surface, each wall having a hole in  
10 the direction of belt travel and aligned with the hole in the opposing wall;

11 an axle supported in the aligned holes; and

12 a roller disposed in the cavity with a salient portion protruding above the upper article  
13 conveying surface and encircling the axle for rotation about an axis of rotation defined by the  
14 axle;

15 wherein at least one of the aligned holes opens into a gap between consecutive hinge  
16 elements along an end of the belt module.